

Discharge of non-acute coronary syndrome (ACS) chest pain patients from emergency care to an advanced nurse practitioner led chest pain clinic: A cross sectional study of referral source and final diagnosis.

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Abstract

Background: Chest pain is a common presentation to emergency departments (ED). Pathways for patients with non-ACS chest pain are not optimal. An advanced cardiology nurse led chest pain service was commenced to address this. The aim of the study was assess outcomes of non-ACS patients discharged from ED to an advanced cardiology nurse-led chest pain clinic and compare by referral type (nurse or ED physician).

Methods: The service consisted of advanced cardiology nurse or ED physician consultation in the ED and discharge to advanced nurse led chest pain clinic review < 72 hours after discharge. Referrals were by the advanced nurses during consult hours and out-of-hours by the ED physicians. Data were extracted from case notes. This was a one site cross sectional study of patients attending the chest pain clinic over two years.

Results: Confirmed coronary disease was diagnosed in 24% of patients. Of the 1041 patients, 45% were referred by the advanced nurses who referred significantly more patients that were older (56.5 yrs./52.3 yrs.); had positive exercise stress test (21%/12%), diagnosed stable coronary artery disease (19%/11%) and less patients with musculoskeletal diagnosis (5%/13%) and other non-cardiac pain (36%/45%).

Conclusions: The study fills a gap in the literature on the follow up of non-ACS patients who present to ED, and utilised advanced cardiology nursing expertise in the ED and chest pain clinic. The advanced nurse referred more patients who were diagnosed with coronary disease reflecting the expertise, experience and efficiency of the advanced cardiology nurse led service.

Keywords

Chest pain, Nurse led clinic, Nurse practitioner, coronary heart disease, non-cardiac chest pain, emergency department

What's New

- An alternative model of care for non-ACS chest pain management in the ED
- Utilises the expertise of an advanced nurse practitioner and cardiology nurse specialists as an alternative to the chest pain unit.
- Advanced cardiology nurse consultation in the ED resulted in more appropriate referral to the chest pain clinic, compared to the ED physician, maximising resource use.
- The diagnosis and management of 15% prevalence of SCAD in this population can be seen as prevention of future ACS and 9% non-obstructive CHD as prevention of future SCAD.

Introduction

Internationally chest pain is a common presentation to Emergency Departments (ED), accounting for 5-10% of ED visits annually ^{1,2,3} and 25% of hospital admissions. Algorithms and protocols have been developed to ensure prompt detection and treatment of Acute Coronary Syndrome (ACS),^{4,5} however over 90% of chest pain presentations are unrelated to ACS ⁶ and there are less standardised protocols and treatment for this group ⁷. Across Europe chest pain assessment units linked to ED provide a common route to manage the patient who presents with chest pain^{8,9} focusing on prompt diagnosis and management of ACS. Whilst there is evidence of the benefits of the role of the chest pain unit reducing overall hospital admissions,^{8,9} this option still has cost implications related to staffing, equipment and space within the ED setting, a setting renowned for its stresses.⁸

Recently specific protocols and practices have been developed to facilitate direct discharge from the ED. These range from; a two-hour accelerated diagnostic protocol (ADP)^{10,11} a chest pain diagnostic algorithm facilitating discharge followed by outpatient

stress testing within 48 hours¹² the New Vancouver chest pain prediction rule ^{13,14}; and chest pain patients discharged from ED who underwent exercise stress testing within one week of discharge.¹⁵ Collectively these studies showed the reduced need for lengthy assessment and suitability for early ED discharge whilst maintaining a low rate of patients experiencing a MACE (major adverse cardiac event) of 0-2.8 % at 30 days.¹⁰⁻¹⁵ These studies contain a small number of patients in relation to the numbers of chest pain presentations to the health care system and mainly focus on ADP development, MACE and ACS outcomes with physician led models. There is a lack of published data on the outcome and final diagnosis of non-ACS patients discharged directly from ED and the application of alternative models of care.

In 1998 the Government of Ireland through the Commission on Nursing ¹⁶ recognised that promotional opportunities should be available to nurses wishing to stay in clinical practice. It recommended that a clinical career pathway, to include registered nurse, clinical nurse specialist (CNS) and registered advanced nurse/midwife practitioner (RANP/AMP) posts, be developed ¹⁶. Figure 1 shows the core competencies of RANP and CNS posts

In Ireland there is regional accreditation of CNS posts through the nursing midwifery planning and development units (NMPDUs) whilst RANP practice is nationally regulated by the Nursing and Midwifery Board of Ireland (NMBI). Registration as a RANP incorporates a structured framework for RANP post accreditation and individual registration.¹⁷ The process leading to successful registration is multi factorial incorporating; education to master's degree, site preparation, job description creation, competency attainment, evidence of at least 500 hours supervised clinical practice and portfolio submission, culminating with registration on a separate division of the NMBI register. ¹⁸ The establishment of these roles with their additional competences allowed for significant health care reform and the evolution of alternative models of care. Evaluation to date indicates that they have already demonstrated added value to patients and services. ¹⁹

This study evaluates an alternative RANP led model of managing non-ACS chest pain patients presenting at ED. The primary aim was to determine the characteristics and outcomes of non-ACS chest pain patients discharged from ED and referred to an advanced nurse led outpatient chest pain clinic (chest pain clinic). There were two main objectives; firstly to determine the overall patient profile and final diagnosis (stable coronary artery disease (SCAD) ²⁰ of these patients, and secondly to compare the patient profile and outcomes by clinic referral type (advanced cardiology nurse or ED physician).

Method

Study design and population

The study was a one site cross sectional study of patients referred upon discharge from the ED to an advanced cardiology nurse led outpatient chest pain clinic (chest pain clinic). The study took place in a large tertiary level acute urban teaching hospital in Dublin, Ireland. All patients who were referred from ED to the chest pain clinic were included in the study. There were no exclusion criteria. Data were collected from December 2011 to end of March 2014.

Setting

A five day (weekdays) advanced nurse led chest pain service was established in the site in December 2011 to facilitate safe discharge from the ED of non-ACS chest pain patients. One RANP in cardiology and two CNS in cardiology (advanced cardiology nurses provide the service with both the CNS and/or RANP undertaking the initial clinical assessment. The RANP is autonomous¹⁷ and may terminate an episode of care, and as such each case is managed with the RANP and a treatment plan developed.

There are two components to the advanced nurse led service, i) RANP/CNS consultation and assessment in the ED culminating in RANP discharge home with appointment to attend the advanced nurse led chest pain clinic within 72 hours ii) RANP led chest outpatient pain clinic review for further assessment and exercise stress testing (Bruce protocol).

The ADP (Figure 2) ²⁰⁻²² assessment in ED by the advanced cardiology nurse included: advanced physical assessment, history of presenting complaint, past medical/surgical history, medications, cardiovascular risk factors, Bio-markers hs-TnT (high sensitivity Troponin T) at 0 hrs and 3 hour repeat if required, resting ECG, kidney function and the GRACE (Global Registry for Acute Coronary Events) risk stratification score.^{4, 21} The objective of the nurse led service is to expertly assess, risk stratify and plan appropriate care for those non-ACS patients with suspected SCAD incorporating investigation, diagnosis and treatment, whilst avoiding unnecessary hospital admission. Patients diagnosed with non-cardiac chest pain (NCCP) ²³ are discharged to primary care and those with suspected SCAD are discharged home from the ED and with a referral to the chest pain clinic by the advanced cardiology nurse during consult hours and out-of-hours by ED physicians.

Data collection

All data were collected as part of routine care from case notes, anonymised and individual consent was not required. Ethical approval was given by the local research ethics committee. This research was conducted according to the provisions of the Declaration of Helsinki. The following diagnostic criteria were utilised.

- Obstructive Coronary Heart Disease (CHD) : found during invasive coronary angiography is $\geq 70\%$ diameter stenosis of at least one major epicardial artery segment or $\geq 50\%$ diameter stenosis in the left main coronary artery. ²²
- Non-obstructive CHD: is defined as an atherosclerotic plaque of $<70\%$ but $> 10\%$ of the lumen in at least one major vessel. ²⁴
- Stable coronary artery disease (SCAD) as per the European Society of Cardiology (ESC) guidelines on the management of stable coronary artery disease 2013. ²⁰

Analysis

Data were analysed using SPSS version 20. Means and frequencies were used to describe the data. To analyse the relationship between patient profile factors and method of referral to the chest pain clinic, Chi squared test and *t* test were used as appropriate. To meet these analyses needs, assuming a medium effect size (0.8), alpha of 0.05, and power of 0.80 a sample size of 128 was required²⁵. The significant level was corrected for Bonferroni adjustment for 11 tests and was therefore set at 0.005.

Results

Overall patient profile and diagnosis

During the study period 1041 patients were referred to the chest pain clinic; the sample population. The mean age was 54 years (20-87 years), 53% were male, 18% had a previous history of cardiovascular disease (CVD) (coronary arterial, peripheral arterial and/ or cerebrovascular disease) and 92% had a low GRACE score (Table 1). Sixty per cent met recommended timeframe from ED to chest pain clinic (72 hours)²⁶, 30% were seen in seven days, 10% greater than seven days.

Following chest pain clinic assessment a differential diagnosis of NCCP was indicated in the majority of patients (64%), potential SCAD in 35% and one percent had evolving ACS detected (Table 1).

Of those patients with a differential diagnosis of SCAD, 92% (337) were referred for further investigation (221 coronary angiogram, 116 computed tomography coronary angiography (CTCA)). Upon completion of diagnostic testing the definitive diagnosis of the total sample indicated that 15% were diagnosed with obstructive CHD and nine per cent with non-obstructive CHD (Table 1). Of those diagnosed with obstructive CHD, 22 were treated with percutaneous intervention (PCI) and seven with coronary artery bypass grafts (CABG).

Non cardiac chest pain was the final diagnosis in 76% of the sample. The most common final non cardiac diagnoses were in order of greatest; NCCP with no obvious causative factor, gastrointestinal chest pain, musculoskeletal chest pain and other i.e. arrhythmia, hypertension.

Of the total study population the most recent mortality report (at 14-27 months post chest pain clinic attendance) confirmed five deaths (0.4%). Three deaths were non cardiac (cancer and liver disease) and two cardiac; one awaiting CABG and one from severe pre-existing vascular disease.

Referral type from ED to chest pain clinic

Forty-five per cent of patients were referred by the advanced cardiology nurses and 55% by the ED physicians (Table 2). Those referred by the advanced cardiology nurse were significantly more likely to be older, to have a history of vascular disease, an intermediate GRACE score and a differential diagnosis of potential SCAD (Table 2). Exercise stress test results and confirmed final diagnosis were also significantly different depending on mode of referral (Table 2) and the advanced cardiology nurse was significantly less likely to refer to the chest pain clinic those with a differential diagnosis of musculoskeletal chest pain or other NCCP (Table 2).

Discussion

Driven by international trends and the National Cardiovascular Health policy of Ireland ²⁶ to address the needs of patients with potential SCAD and to minimise admission from the ED, this site set up a unique, evidenced based RANP nurse led service enabling early discharge from ED with outpatient follow-up care within 72 hours ²⁶. This offers an alternative to the traditional chest pain unit model. There is a dearth of comparable published research on outcomes and diagnosis of chest pain patients discharged from ED once ACS has been ruled out. In this study the overall diagnostic yield of confirmed CHD (15%) is comparable to UK rapid access chest pain clinics (RAPACS) ²⁷⁻²⁹.

This study found that the cohort of patients originally assessed in the ED by the advanced cardiology nurse were significantly more likely to be older, have a history of vascular disease and intermediate GRACE risk, indicating more appropriate selection of patients with potential SCAD for chest pain clinic follow up. This may reflect the substantial cardiology experience, education and clinical gestalt ³⁰ of the advanced cardiology nurse and collaboratively managed care in comparison to the ED physician.

Non cardiac chest pain patients are high users of healthcare services and incur high costs to healthcare systems,³¹ therefore early diagnoses and rule out of CHD can impact positively on costs through appropriate admission avoidance. In this study, 76% of patients had a final diagnosis of NCCP. The proportion was significantly lower in those referred by the cardiology nurse (70%) than the ED physician (82%), indicating that in the ED setting the advanced cardiology nurse identified more patients with potential SCAD as a differential diagnosis than the ED physician. A significant variation in differential diagnosis by referral type was musculoskeletal NCCP. Musculoskeletal chest pain is estimated to account for up to 50% of all NCCPs in the primary care setting, and in this study accounted for almost 10% of overall final diagnosis³². Musculoskeletal examination of the upper chest wall and shoulders to elicit reproducible symptoms is a key component of the advanced physical assessment of the chest pain patient performed by the cardiology nurse in addition, to obtaining a detailed history of presenting complaint and health history.

Guidelines suggest that the diagnosis of angina can be made on clinical history alone²² and Reigle suggests that a 'thorough and detailed history often leads to the correct diagnosis'.³³ This study validates the skills of the advanced cardiology nurse who has attained additional competencies in skilled health history taking.³⁴ It also shows the effectiveness of an innovative aspect of this model of care utilising the advanced cardiology nurse in the ED.

It has been suggested that for certain chest pain patients follow up with a specialist cardiologist was related to a decreased rate of all-cause mortality or myocardial infarction at one year, recommending expert follow up in tandem with provocative and diagnostic testing.³⁵ The findings of this study support the premise that this could be an expertly trained cardiology nurse practitioner/specialist (being a constant in healthcare service provision, whilst junior doctors rotate every three to six months).

Once ACS has been ruled out the identification of patients with SCAD is vital as it estimated to currently affect approximately eight per cent of individuals²²; this study

suggests 15%. The treatment pathway and prognosis of SCAD patients is still not optimal. Prognosis can be improved through identification, risk stratification and prevention strategies.^{36, 37} These patients had the opportunity for early diagnosis, education and treatment which may lead to increased prevention behaviours and could be seen as prevention of future ACS.

Nine per cent of patients were diagnosed with non-obstructive CHD after invasive testing. A recent study has shown that of those with evidence of non-obstructive CHD post coronary angiogram up to one percent had a risk of myocardial infarction at one year³⁸ and can be a cause of ACS in women³⁹. Non-obstructive CHD indicates the need for preventative therapies and lifestyle changes and referral to the nurse led chest pain clinic presented the opportunity to commence these changes together with risk factor education.

In this study, those with a new diagnosis of one to three vessel disease, non-obstructive heart disease and those with a previous history of CVD made up nearly 1/4 (23%) of non ACS chest pain patient presenting to the ED. This shows the potential for future ACS prevention.

It is estimated globally that one to four per cent of ACS patients may be 'missed' within the ED setting.^{40, 41} This study safely captured the one per cent late evolving ACS and the mortality rate of 0.4% is good compared to previous studies of low risk patient discharged from a chest pain unit (1.7%)⁴² and reflects the current evidence that nurse-led clinics have good outcomes for all-cause mortality⁴³ evidencing patient safety.

This large study fills a gap in the literature regarding the final diagnoses of non-ACS patients following protocol driven discharge directly from the ED and presents an alternative advanced nurse led model of care. In comparison to available literature, this study has a large cohort of patients.^{12, 15, 42}

Limitations

In the application for ethics the extraction of data were confined to the nurse led chest pain clinic, therefore the study was unable to review the pathways of those patients not

referred to the outpatients clinic from ED, i.e. those that were discharged home or admitted. This study focuses on patients in whom ACS has been ruled out in the initial ED assessment.

Conclusion

As ACS rates continue to decline and ACS programmes redirect those patients to specialised centres with primary PCI facilities, the ED physician will be exposed to more non-ACS patients. In the emergency setting once ACS has been ruled out the identification of patients with SCAD is vital in the prevention of future ACS. This study demonstrated the successful utilisation of an alternative advanced cardiology nurse led model that was safe and effective. The advanced cardiology nurse, utilised additional education and competencies to provide comprehensive assessment, appropriate discharge from ED, timely follow up and a diagnosis for those with potential SCAD.

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Figure 1: Core competencies of Registered Advanced Nurse Practitioner

- Autonomy in clinical practice
- Expert practice
- Professional and clinical leadership
- Research

National Council for the Professional Development of Nursing and Midwifery. Framework for the Establishment of Clinical Nurse/Midwife Specialist Posts Intermediate Pathway 3rd Edition 2007

Core Competencies of Clinical Nurse Specialist

- Clinical Focus
- Patient/client advocate
- Education and training
- Audit & research
- Consultancy

National Council for the Professional Development of Nursing and Midwifery. Framework for the Establishment of Clinical Nurse/Midwife Specialist Posts 4th Edition 2008

Table 1: Overall profile of the patients who attended the nurse led chest pain outpatient clinic (n=1041)

Variable (n)	Category	% (n)
Age presenting at Clinic	<i>Mean age</i>	54.2yrs (±12.5)
Sex	<i>Males</i>	53% (552)
	<i>Females</i>	47% (489)
Referral pathway to Emergency Dept.	<i>General physician (GP) referral</i>	56% (586)
	<i>Self-referral</i>	43% (444)
	<i>Other</i>	1%(11)
How patients were referred to outpatient clinic from emergency department	<i>Cardiology Nurse consultation</i>	45% (467)
	<i>Emergency Dept. Physician consultation</i>	55% (574)
GRACE risk score	<i>Low</i>	92% (961)
	<i>Intermediate</i>	7% (75)
	<i>High</i>	0.5% (5)
Pre-existing Cardiovascular disease	<i>Yes</i>	18% (186)
	<i>No</i>	82% (855)
Differential diagnosis	<i>Suspected stable coronary artery disease (SCAD)</i>	35% (368)
	<i>Acute Coronary Syndrome</i>	1% (9)
	<i>Other non-cardiac chest pain (NCCP)</i>	64% (664)
Confirmed diagnosis (1033)	<i>Obstructive coronary heart disease</i>	15% (150)
	<i>Non Obstructive coronary heart disease</i>	9% (90)
	<i>Non-cardiac chest pain</i>	76% (788)
	<i>Pre existing coronary heart disease</i>	0.4% (5)

Table 2: Comparison of profile, outcome and treatment of patients referred to chest clinic by cardiology nurse consultation and emergency department doctors (n=1041 unless otherwise stated)

		Cardiology nurse referral (467)	ED physician referral (574)	Chi	p	eta
Age		56.5 ±12.3	52.3±12.3	5.6#	<0.001 *	0.03
Sex	<i>Males (552)</i>	56% (261/467)	51% (291/574)	2.6	0.11	0.05
	<i>Females (489)</i>	44% (206/467)	49% (283/574)			
Pre-existing cardiovascular disease	<i>Yes (186)</i>	24% (114/467)	13% (72/574)	23.9	<0.001 *	0.15
Grace risk score (1036)	<i>Low (961)</i>	90% (415/463)	95% (546/573)	11.37	<0.001 *	0.18
	<i>Intermediate (75)</i>	10% (48/463)	5% (27/573)			
Stress test result (896)	<i>Positive (146)</i>	21% (87/418)	12% (59/478)	15.6	<0.001 *	0.13
	<i>Inconclusive (158)</i>	18% (76/418)	15% (72/478)			
	<i>Negative (602)</i>	61% (255/418)	73% (347/478)			
Differential diagnosis	<i>Suspected stable coronary artery disease (SCAD) (368)</i>	44% (204/467)	29% (164/574)	25.73	<0.001 *	
	<i>Acute coronary syndrome(9)</i>	1% (4/467)	1% (5/574)			

	<i>Gastrointestinal(106)</i>	12% (58/467)	8% (48/574)	4.635	0.031	
	<i>Musculoskeletal(101)</i>	5% (24/467)	13% (77/574)	20.12 9	<0.001 *	
	<i>Other non cardiac pain(425)</i>	36% (167/467)	45% (258/574)	8.997	0.003	
	<i>Other (32)</i>	2% (10/467)	4% (22/574)	2.473	0.148	
Confirmed diagnosis (1028)	<i>Non cardiac chest pain (788)</i>	70% (323/460)	82% (465/568)	19.3	<0.001 *	0.14
	<i>Obstructive coronary heart disease (150)</i>	19% (85/460)	11% (65/568)			
	<i>Non Obstructive coronary heart disease (90)</i>	11% (52/460)	7% (38/568)			

T test

*Significant at the Bonferroni adjusted p level = 0.001